

## Sources of Energy

**Question 1:** What is a good source of energy?

**Answer:** A good source of energy fulfils the following criteria:

- (I) It produces a lot of heat per unit mass.
- (II) It does a huge amount of work per unit mass.
- (III) It is easily accessible.
- (IV) It is easy to store and transport.
- (V) It is economical.
- (VI) It produces less amount of smoke.

**Question 2:** What is a good fuel?

**Answer:** A good fuel produces a huge amount of heat on burning, does not produce a lot of smoke, and is easily available.

**Question 3:** If you could use any source of energy for heating your food, which one would you use and why?

**Answer:** Natural gas can be used for heating and cooking food because it is a clean source of energy. It does not produce huge amount of smoke on burning. Although it is highly inflammable, it is easy to use, transport, and it produces a huge amount of heat on burning.

**Question 4:** What are the disadvantages of fossil fuels?

**Answer:** The disadvantages of fossil fuels are as follows:

- (a) Burning of coal and petroleum produces a lot of pollutants causing air pollution.
- (b) Fossil fuels release oxides of carbon, nitrogen, sulphur, etc. that cause acid rain, which affects the soil fertility and potable water.
- (c) Burning of fossil fuels produce gases such as carbon dioxide that causes global warming.

**Question 5:** Why are we looking at alternate sources of energy?

**Answer:** Fossil fuels, which have been traditionally used by human beings as an energy sources, are non-renewable sources of energy. These sources of energy are limited and cannot replenish on their own. They are being consumed at a large rate. If this rate of consumption continues, then

the fossil fuels would be exhausted from the Earth. Therefore, we have to conserve the energy sources. Hence, we should look for alternate sources of energy.

**Question 3:** How has the traditional use of wind and water energy been modified for our convenience?

**Answer:** Traditionally, waterfalls were used as a source of potential energy which was converted to electricity with the help of turbines. Since waterfalls are few in number, water dams have been constructed in large numbers. Nowadays, hydro-dams are used in order to harness potential energy of stored water. In water dams, water falls from a height on the turbine, which produces electricity.

Earlier, the windmills were used to harness wind energy to do mechanical work such as lifting/drawing water from a well. Today, windmills are used to generate electricity. In windmills, the kinetic energy of wind is harnessed and converted into electricity. The rotatory motion of the blades turns the turbine of the electric generator to generate electricity.

**Question 4:** What kind of mirror – concave, convex or plain – would be best suited for use in a solar cooker? Why?

**Answer:** A solar cooker uses heat of the sunlight to cook and heat food. A mirror is used in order to reflect and focus sunlight at a point. A concave mirror is used in a solar cooker for this purpose. The mirror focuses all the incident sunlight at a point. The temperature at that point increases, thereby cooking and heating the food placed at that point.

**Question 5:** What are the limitations of the energy that can be obtained from the oceans?

**Answer:** The forms of energy that can be obtained from the ocean are tidal energy, wave energy, and ocean thermal energy. There are several limitations in order to harness these energies.

- (i) Tidal energy depends on the relative positioning of the Earth, moon, and the Sun.
- (ii) High dams are required to be built to convert tidal energy into electricity.
- (iii) Very strong waves are required to obtain electricity from wave energy.
- (iv) To harness ocean thermal energy efficiently, the difference in the temperature of surface water (hot) and the water at depth (cold) must be 20°C or more.

**Question 6:** What is geothermal energy?

**Answer:** Geothermal power plants use heat of the Earth to generate electricity. This heat energy of the Earth is known as geothermal energy.

When there are geological changes, the molten rocks present in the core of the earth are pushed to the earth's crust. This forms regions of hot spot. Steam is generated when the underground

water comes in contact with these hot spots forming hot springs. This trapped steam is used to generate electricity in the geothermal power plants.

**Question 7:** What are the advantages of nuclear energy?

**Answer:** The advantages of nuclear energy are as follows:

- (a) Large amount of energy is produced per unit mass.
- (b) It does not produce smoke. It is a clean energy.
- (c) Fission of one atom of uranium produces 10 million times the energy released by burning of one atom of carbon.
- (d) Fusion of four hydrogen atoms produces huge amount of energy approximately equal to 27 MeV.

**Question 8:** Can any source of energy be pollution-free? Why or why not?

**Answer:** No source of energy can be pollution-free. It is considered that solar cells are pollutionfree. However, even their making causes environmental damage indirectly.

Also, in the case of nuclear energy, there is no waste produced after the fusion reactions. However, it is not totally pollution-free. To start the fusion reactions, approximately 10<sup>7</sup> K temperature is required, which is provided by fission reactions. The wastes released from fission reactions are very hazardous. Hence, no source of energy is pollution-free.

**Question 9:** Hydrogen has been used as a rocket fuel. Would you consider it a cleaner fuel than CNG? Why or why not?

**Answer:** Hydrogen gas is cleaner than CNG. CNG contains hydrocarbons. Therefore, it has carbon contents. Carbon is a form of pollutant present in CNG. On the other hand, hydrogen is waste-free. The fusion of hydrogen does not produce any waste. Hence, hydrogen is cleaner than CNG.

**Question 10:** Name two energy sources that you would consider to be renewable. Give reasons for your choices.

**Answer:** Two renewable sources of energy are as follows:

- (a) Sun: The energy derived from the Sun is known as solar energy. Solar energy is produced by the fusion of hydrogen into helium, fusion of helium into other heavy elements, and so on. A large amount of hydrogen and helium is present in the Sun. Therefore, solar energy can replenish on its own. The Sun has 5 billion years more to burn. Hence, solar energy is a renewable source of energy.

(b) Wind: Wind energy is derived from air blowing with high speed. Wind energy is harnessed by windmills in order to generate electricity. Air blows because of uneven heating of the Earth. Since the heating of the Earth will continue forever, wind energy will also be available forever.

**Question 11:** Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.

**Answer:** Two exhaustible energy sources are as follows:

(a) Coal: It is produced from dead remains of plants and animals that remain buried under the earth's crust for millions of years. It takes millions of years to produce coal. Industrialization has increased the demand of coal. However, coal cannot replenish within a short period of time. Hence, it is a non-renewable or exhaustible source of energy.

(b) Wood: It is obtained from forests. Deforestation at a faster rate has caused a reduction in the number of forests on the Earth. It takes hundreds of years to grow a forest. If deforestation is continued at this rate, then there would be no wood left on the Earth. Hence, wood is an exhaustible source of energy.

**Question 12:**

A solar water heater cannot be used to get hot water on

- |                 |                  |
|-----------------|------------------|
| (a) a sunny day | (b) a cloudy day |
| (c) a hot day   | (d) a windy day  |

**Answer:**

(b)

A solar water heater uses solar energy to heat water. It requires bright and intense sunlight to function properly. On a cloudy day, the sunlight reflects back in the sky from the clouds and is unable to reach the ground. Therefore, solar energy is not available for the solar heater to work properly. Hence, solar water heater does not function on a cloudy day.

**Question 13:** A solar water heater cannot be used to get hot water on

- (a) a sunny day (b) a cloudy day
- (c) a hot day (d) a windy day

**Answer:** (b) A solar water heater uses solar energy to heat water. It requires bright and intense sunlight to function properly. On a cloudy day, the sunlight reflects back in the sky from the clouds

and is unable to reach the ground. Therefore, solar energy is not available for the solar heater to work properly. Hence, solar water heater does not function on a cloudy day.

**Question 14:** Which of the following is not an example of a bio-mass energy source?

- (a) wood      (b) gobar gas
- (c) nuclear energy (d) coal

**Answer:** (c) Bio-mass is a source of energy that is obtained from plant materials and animal wastes. Nuclear energy is released during nuclear fission and fusion. In nuclear fission, uranium atom is bombarded with low-energy neutrons. Hence, uranium atom splits into two relatively lighter nuclei. This reaction produces huge amount of energy. In nuclear fusion reaction, lighter nuclei are fused together to form a relatively heavier nuclei. This reaction produces tremendous amount of energy. Hence, nuclear energy is not an example of bio-mass energy source.

Wood is a plant material, gobar gas is formed from animal dung, and coal is a fossil fuel obtained from the buried remains of plants and animals. Hence, these are bio-mass products.

**Question 15:** Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the Sun's energy?

- (a) Geothermal energy
- (b) Wind energy
- (c) Nuclear energy
- (d) Bio-mass

**Answer:** (c) Nuclear energy is released during nuclear fission and fusion. In nuclear fission, uranium atom is bombarded with low-energy neutrons. Hence, uranium atom splits into two relatively lighter nuclei. This reaction produces huge amount of energy. In nuclear fusion reaction, lighter nuclei are fused together to form a relatively heavier nuclei. The energy required to fuse the lighter nuclei is provided by fission reactions. This reaction produces tremendous amount of energy. These reactions can be carried out in the absence or presence of sunlight. There is no effect of sunlight on these reactions. Hence, nuclear energy is not ultimately derived from Sun's energy.

Geothermal energy, wind energy, and bio-mass are all ultimately derived from solar energy.

Geothermal energy is stored deep inside the earth's crust in the form of heat energy. The heating is caused by the absorption of atmospheric and oceanic heat. It is the sunlight that heats the atmosphere and oceans.

Wind energy is harnessed from the blowing of winds. The uneven heating of the earth's surface by the Sun causes wind.

Bio-mass is derived from dead plants and animal wastes. Chemical changes occur in these dead plants and animal wastes in the presence of water and sunlight. Hence, bio-mass is indirectly related to sunlight.

**Question 16:** Compare and contrast fossil fuels and the Sun as direct sources of energy.

**Answer:** Fossil fuels are energy sources, such as coal and petroleum, obtained from underneath the Earth's crust. They are directly available to human beings for use. Hence, fossil fuels are the direct source of energy. These are limited in amount. These are non-renewable sources of energy because these cannot be replenished in nature. Fossil fuels take millions of years for their formation. If the present fossil fuel of the Earth gets exhausted, its formation will take several years. Fossil fuels are also very costly.

On the other hand, solar energy is a renewable and direct source of energy. The Sun has been shining for several years and will do so for the next five billion years. Solar energy is available free of cost to all in unlimited amount. It replenishes in the Sun itself.

**Question 17:** Compare and contrast bio-mass and hydro electricity as sources of energy.

**Answer:** Bio-mass and hydro-electricity both are renewable sources of energy. Bio-mass is derived from dead plants and animal wastes. Hence, it is naturally replenished. It is the result of natural processes. Wood, gobar gas, etc. are some of the examples of bio-mass.

Hydro-electricity, on the other hand, is obtained from the potential energy stored in water at a height. Energy from it can be produced again and again. It is harnessed from water and obtained from mechanical processes.

**Question 18:** What are the limitations of extracting energy from –

(a) the wind? (b) waves? (c) tides?

**Answer:** (a) Wind energy is harnessed by windmills. One of the limitations of extracting energy from wind is that a windmill requires wind of speed more than 15 km/h to generate electricity. Also, a large number of windmills are required, which covers a huge area.

(b) Very strong ocean waves are required in order to extract energy from waves.

(c) Very high tides are required in order to extract energy from tides. Also, occurrence of tides depends on the relative positions of the Sun, moon, and the Earth.

**Question 19:** On what basis would you classify energy sources as

(a) renewable and non-renewable?

(b) exhaustible and inexhaustible?

Are the options given in (a) and (b) the same?

**Answer:** (a) The source of energy that replenishes in nature is known as renewable source of energy. Sun, wind, moving water, bio-mass, etc. are some of the examples of renewable sources of energy.

The source of energy that does not replenish in nature is known as non-renewable source of energy. Coal, petroleum, natural gas, etc. are some of the examples of non-renewable sources of energy.

(b) Exhaustible sources are those sources of energy, which will deplete and exhaust after a few hundred years. Coal, petroleum, etc. are the exhaustible sources of energy.

Inexhaustible resources of energy are those sources, which will not exhaust in future. These are unlimited. Bio-mass is one of the inexhaustible sources of energy.

Yes. The options given in (a) and (b) are the same.

**Question 20:** What are the qualities of an ideal source of energy?

An ideal source of energy must be:

- I. Economical
- II. Easily accessible
- III. Smoke/pollution free
- IV. Easy to store and transport
- V. Able to produce huge amount of heat and energy on burning

**Question 21:** What are the advantages and disadvantages of using a solar cooker? Are there places where solar cookers would have limited utility?

**Answer:** Solar cooker uses Sun's energy to heat and cook food. It is inexhaustible and clean renewable source of energy. It is free for all and available in unlimited amount. Hence, operating a solar cooker is not expensive.

Disadvantage of a solar cooker is that it is very expensive. It does not work without sunlight. Hence, on cloudy day, it becomes useless.

The places where the days are too short or places with cloud covers round the year, have limited utility for solar cooker.

**Question 22:** What are the environmental consequences of the increasing demand for energy? What steps would you suggest to reduce energy consumption?

**Answer:** Industrialization increases the demand for energy. Fossil fuels are easily accessible sources of energy that fulfil this demand. The increased use of fossil fuels has a harsh effect on the environment. Too much exploitation of fossil fuels increases the level of green house gas content in the atmosphere, resulting in global warming and a rise in the sea level.

It is not possible to completely reduce the consumption of fossil fuels. However, some measures can be taken such as using electrical appliances wisely and not wasting electricity. Unnecessary usage of water should be avoided. Public transport system with mass transit must be adopted on a large scale. These small steps may help in reducing the consumption of natural resources and conserving them.